Title 10 – DEPARTMENT OF NATURAL RESOURCES
Division 20 – Clean Water Commission
Chapter 8 – Design Guides

DRAFT AMENDMENT

10 CSR 20-8.110 Engineering – Reports, Plans and Specifications. The Missouri Department of Natural Resources (Department) is amending the purpose, sections (1), (6), (7), and (8), and subsection (4)(B); adding a new subsection (1)(A), sections (2), (3), (4) and (5), and Figure 1; and deleting the editor's note, sections (2), (3), (5), and (9), and section (4) through subparagraph (4)(A)9.J of the rule in the *Code of State Regulations*.

INTENTION OF DRAFT AMENDMENT: This amendment will update the rule to current industry practices. Providing specific and clear requirements for engineering reports, facility plans, plans and specifications will increase understanding and efficiency of submitted and reviewed construction permit applications.

PURPOSE: The following criteria have been prepared as a guide for the preparation of engineering reports or facility plans and detail plans and specifications. This rule is to be used with rules 10 CSR 20-8.120 [-] ***through*** *10 CSR 20-8.220 for the planning and design of the complete treatment facility. This rule reflects the minimum requirements of the Missouri Clean Water Commission [as]* ***in*** *regard to adequacy of design, submission of plans, approval of plans and approval of completed [sewage works]* ***wastewater treatment facilities****.* ***It is not reasonable or practical to include all aspects of design in these standards. The design engineer should obtain appropriate reference materials which include but are not limited to: copies of all ASTM International standards, design manuals such as Water Environment Federation's Manuals of Practice (MOPs) and other sewer and wastewater treatment design manuals that are considered as containing principles of accepted engineering practice.*** *Deviation from these minimum requirements will be allowed where sufficient documentation is presented to justify the deviation. These criteria are taken largely from* ***the 2004 edition of the*** *Great Lakes-Upper Mississippi River Board of State [Sanitary Engineers]* ***and Provincial Public Health and Environmental Managers "****Recommended Standards for [Sewage Works]* ***Wastewater Facilities"*** *and are based on the best information presently available. These criteria were originally filed as 10 CSR 20-8.030. It is anticipated that they will be subject to review and revision periodically as additional information and methods appear. [Addenda or supplements to this publication will be furnished to consulting engineers and city engineers. If others desire to receive addenda or supplements, please advise the Clean Water Commission so that names can be added to the mailing list.]*

(1) Definitions. Definitions as set forth in the Clean Water Law and 10 CSR 20-2.010 shall apply to those terms when used in this rule, unless the context clearly requires otherwise. Where the terms shall and must are used, they are to mean a mandatory requirement insofar as approval by the [*agency*] **Missouri Department of Natural Resources (Department)** is concerned, unless justification is presented for deviation from the requirements. Other terms, such as should, recommend, preferred and the like, indicate [*discretionary requirements on the part of the agency and deviations are subject to individual consideration*] **the preference of the Department for consideration by the design engineer**.

(A) Deviations. Deviations from these rules may be approved by the Department when engineering justification satisfactory to the Department is provided. Justification must substantially demonstrate in writing and through calculations that a variation(s) from the design rules will result in either at least equivalent or improved effectiveness. Deviations are subject to case-by-case review with individual project consideration.

[(2) *Exceptions. This rule shall not apply to facilities designed for twenty-two thousand five hundred (22,500) gallons (85.4 m^3) per day or less (see 10 CSR 20-8.020 for the requirements for those facilities).*]

(2) Applicability. This rule shall apply to all facilities with a design flow of one hundred thousand (100,000) gallons (378.5 m^3) per day or greater. This rule shall also apply to all facilities with a design flow of twenty-two thousand five hundred (22,500) gallons (85.2 m^3) per day or greater until such time as 10 CSR 20-8.020 is amended.

[*(3) Engineering services are performed in three (3) steps-engineering report or facilities plan; preparation of construction plans, specifications and contractual documents; and construction compliance, inspection, administration and acceptance. These services are generally performed by engineering firms in private practice but may be executed by municipal, state or federal agencies. All reports, plans and specifications should be submitted at least sixty (60) days prior to the date upon which action by the agency is desired, or in accordance with NPDES or other schedules. The documents, at the appropriate times, should be submitted for formal approval and should include the engineer's report (facilities plan) and design drawings and specifications. For nongrant projects which are unusual or complex, it is suggested that the engineer meet with the appropriate regional office to discuss the project and that preliminary reports be submitted for review prior to the preparation of final plans and specifications. These documents are used by the owner in programming future action, by the agency to evaluate probable compliance with statutes and regulations, by bond attorneys and investment houses to develop and evaluate financing and by the news media. Preliminary reports and plans shall broadly describe existing problems; consider methods for alternate solutions including site and/or route selection; estimate capital and annual costs; and outline steps for further project implementation, including financing and approval by regulatory agencies. No approval for construction can be issued until final, detailed plans and specifications have been submitted to the agency and found to be satisfactory.*]

(3) General.

(A) Engineering Services. Engineering services are performed in three steps:

1. Engineering report or facility plan;

2. Preparation of construction plans and specifications; and

3. Contractual documents, construction compliance, inspection, administration, and acceptance.

(B) 10 CSR 20-8.110 Engineering – Reports, Plans and Specifications covers the items in Paragraphs (3)(A)1 and 2 above.

(C) All reports, plans and specifications must be submitted at least one hundred eighty (180) calendar days prior to the date upon which action by the Department is desired, or in accordance with a National Pollutant Discharge Elimination System (NPDES) permit or other Departmental schedules. The documents, at the appropriate times, must be submitted for formal approval and should include the engineer's report or facility plan,

design drawings, and specifications. Engineering reports or facility plans must be approved by the Department prior to the submittal of the design drawings, specifications, and the appropriate permit applications and fees. For projects involving both collection systems and wastewater treatment facilities, the information required in Subsection (4)(B) must be included in the facility plan. These documents are used by the owner in programming future action, by the Department to evaluate probable compliance with statutes and regulations, by bond attorneys and investment houses to develop and evaluate financing. Engineering reports and facility plans should broadly describe existing problems; consider methods for alternate solutions including site and/or route selection; estimate capital and annual costs; and outline steps for further project implementation, including financing and approval by the Department and other agencies. No approval for construction can be issued until final detailed plans and specifications with the design engineer's imprint of his/her registration seal with the date and engineer's signature affixed have been submitted and found to be satisfactory by the Department.

(D) Engineering reports and facility plans shall include a statement identifying the continuing authority, a contact person for the authority and the continuing authority phone number and address along with the design engineer's imprint of his/her registration seal with the date and engineer's signature affixed to the document.

[*(4) Engineering Report or Facility Plan. For construction grant projects the federal regulations describe requirements for the facility plan which must be met. The engineering report, for nongrant projects, assembles basic information; presents design criteria and assumptions; examines alternate projects with preliminary layouts and cost estimates; describes financing methods giving anticipated charges for users; reviews organizational and staffing requirements; offers a conclusion with a proposed project for client consideration; and outlines official actions and procedures to implement the project. The concept, including process description and sizing, factual data and controlling assumptions and considerations for the functional planning of sewerage facilities are presented for each process unit and for the whole system. These data form the continuing technical basis for detail design and preparation of construction plans and specifications. Architectural, structural, mechanical and electrical designs are usually excluded. Sketches may be desirable to aid in presentation of a project. Outline specifications of process units, special equipment, etc., are occasionally included.*

(A) Format for Content and Presentation. It is urged that the following paragraphs be utilized as a guideline for content and presentation of the project engineering report to the agency for review and approval.

1. Title. The wastewater facilities report-collection, conveyance, processing and discharge of wastewater.

2. Letter of transmittal. A one (1) page letter typed on the firm's letterhead and bound into report should include submission of report to the client, statement of feasibility of recommended project, acknowledgment to those giving assistance and reference to project as outgrowth of approved area-wide wastewater management plans.

3. Title page. Title of project; municipality, county or other sponsoring agency; names of officials, managers, superintendents; name and address of firm preparing report; seal and signature of the professional engineer in charge of project.

4. Table of contents. (Number all pages; cross-reference by page number.) Section heading, chapter heading and sub-headings; maps; graphs; illustrations, exhibits; diagrams; appendices.

5. Summary. Highlight, very briefly, what was found from the study.

A. Findings. Population-present, design (when), ultimate; land use and zoning-portion per residential, commercial, industrial, greenbelt, etc.; wastewater characteristics and concentrations-portions of total hydraulic, organic and solids loading attributed to residential, commercial and industrial fractions; collection system projects-immediate needs to implement recommended project, deferred needs to complete recommended project and pump stations, force mains, appurtenances, etc.; selected process and site-characteristics of process expected for effluent quality and description of site, environmental assessment of selected process; receiving waters-existing water quality and quantity, classifications and downstream water uses and impact of project on receiving water; proposed project-total project costs, total annual expense requirements for debt service; operation, personnel and operation and nonpersonnel; finances-indicate financing requirements and typical annual charges; organization-administrative control necessary to implement project, carry through to completion, operate and maintain wastewater facility and system; and changes-alert client to situations that could alter recommended project.

B. Conclusions. Project(s) recommended to client for immediate construction, suggested financing program and other.

C. Recommendations. Summarized, step-by-step actions, for client to follow to implement conclusions-official acceptance of report; adoption of recommended project; submission of report to agency for review and approval; authorization of engineering services for approved project (construction plans, specifications, contract documents, etc.); legal services; enabling ordinances, resolutions, etc., required; adoption of sewer-use ordinance; adoption of operating rules; financing program requirements; organization and administration (structure, personnel, employment, etc.); time schedules-implementation, construction, completion dates, reflecting applicable hearings, stipulations, abatement orders.

6. Introduction. Purpose-reasons for report and circumstances leading up to report; scope-coordination of recommended project with approved comprehensive master plan and guideline for developing the report.

7. Existing conditions and projections.

A. Planning period. Total period of time for which program is to be studied.

B. Land use. Existing area, expansion, annexation, intermunicipal service, ultimate planning area; drainage basin, portion covered; and residential, commercial and industrial land use, zoning, population densities, industrial types and concentrations.

C. Demographic and economic data. Population growth, trends, increase during design of life of facility (graph); assessed valuation, tax structure, tax rates, portions for residential, commercial, industrial property; employment, from within and outside service area; transportation systems, effect on commuter influx, exempt property (schools, colleges, churches, foundations, governmental agencies, etc.) and effect on project; and costs of present water and wastewater services.

D. General. Topography, general geology and effect on project; and meteorology, precipitation, runoff, flooding, etc. and effect on project.

E. Forecasts of flow and waste loads. Water consumption (total, unit, industrial); wastewater flow pattern, peaks, total design flow; physical, chemical and biological characteristics and concentrations; residential, commercial, industrial, infiltration/inflow fractions, considering organic, solids, toxic, aggressive, etc. substances; tabulate each fraction separately and summarize.

F. Local regulations. Existing ordinances and rules including defects and deficiencies, etc.; recommended amendments, revisions or cancellation and replacement; sewer-use ordinance (toxic, aggressive, volatile, etc. substances) surcharge based on volumes and concentration for industrial wastewaters; existing contracts and agreements (intermunicipal, etc.); and enforcement provisions including inspection, sampling, detection, penalties, etc.

8. *Existing facilities evaluation.*

A. Existing collection system. Inventory of existing sewers; isolation from water supply wells; adequacy to meet project needs (structural condition, hydraulic capacity tabulation); gauging and infiltration/inflow analysis; overflows and required maintenance, repairs, improvements and methods for control; outline repair, replacement and storm-water separation requirements; evaluation of costs for treating infiltration/inflow versus cost for rehabilitation of system; establish renovation priorities, if selected; present recommended annual program to renovate sewers; and indicate required annual expenditure.

B. Existing treatment plant site. Area for expansion, terrain, subsurface conditions; isolation from habitation; isolation from water supply structures; enclosures of units, odor control, landscaping, etc.; and flooding (predict elevation of twenty-five (25) and one hundred (100)-year flood stage).

C. Existing facilities. Tabulate capacities and adequacy of units (wastewater treatment, sludge processing and sludge disposal); relationship and/or applicability to proposed project; age and condition; adaptability to different usages; structures to be retained, modified or demolished; and outfall.

D. Existing wastewater characteristics. Water consumption from records (total, unit, industrial); wastewater flow pattern, peaks, total design flow (verify accuracy of installed metering equipment); physical, chemical and biological characteristics and concentrations; residential, commercial, industrial, infiltration/inflow fractions, considering organic solids, toxic, aggressive, etc. substances; tabulate each fraction separately and summarize.

E. Evaluation of unsewered communities. Types of existing residential systems and their construction of deficiencies, operational problems and number of residents served.

9. *Basic project development.*

A. Proposed collection system. Inventory of proposed additions, isolation from water supply wells, reservoirs, facilities, etc.; area of service; unusual construction problems; utility interruption and traffic interference; restoration of pavements, lawns, etc.

B. Design wastewater characteristics. Character of wastewater necessary to insure amenability to process selected; need to pretreat industrial wastewater before discharge to sewers; portion of residential, commercial, industrial wastewater fractions to comprise projected growth.

C. Receiving water considerations. Upstream wastewater discharges; receiving water base flow; characteristics (concentrations) of receiving waters; downstream water uses including water supply, recreation, agricultural, industrial, etc.; impact of proposed discharge on receiving waters; tabulation of plant performance versus receiving water requirements; listing of effluent characteristics; and correlation of plant performance versus receiving water requirements. A determination from the Department of Natural Resources, Division of Geology and Land Survey, of whether the receiving stream is losing or gaining shall be included in the engineering report (facility plan).

D. Effluent limitations. Allowable concentration of pollutants in the effluent based on

10 CSR 20-7.015 Effluent Regulations.
E. Treatment plant site requirements. Compare advantages and disadvantages relative to cost, hydraulic requirements, flood control, accessibility, enclosure of units, odor control, landscaping, etc. and isolation with respect to potential nuisances and protection of water supply facilities.
F. Alternatives. Consider such items as regional solutions, optimum operation of existing facilities, flow and waste reduction, location of facilities, phased construction, necessary flexibility and reliability, sludge disposal, alternative treatment sites, alternative collection and treatment processes and institutional arrangements.
G. Alternative process and sites. Describe and delineate (line diagrams); preliminary design for cost estimates; estimates of total project cost (dated, keyed to construction cost index, escalated, etc.); advantages and disadvantages of each; individual differences, requirements, limitations; characteristics of process output; comparison of process performances; environmental assessment of each (including both primary and secondary impacts); operation and maintenance expense and energy requirements; and annual expense requirements (tabulation of annual operation, maintenance, personnel, debt obligation for each alternate).
H. Selected process and site. Identify and justify process and site selected; adaptability to meet initial and future needs; environmental assessment; outfall location; and describe immediate and deferred construction.
I. Project financing. Review applicable, financing methods; effect of state and federal assistance; assessment (a combination of methods should most probably be applied to distribute cost and expenses as equitably as possible in relation to benefit received) by valuation, front foot, area unit or other benefit; charges (a combination of methods should most probably be applied to distribute cost and expenses as equitably as possible in relation to benefit received) by connection, occupancy, readiness-to-serve, water consumption, industrial wastewater discharge, etc.; existing debt service requirements; bond retirement schedule; tabulate all expenses; show how representative properties and users are to be affected; and show anticipated typical annual charge to user and nonuser.
J. Legal and other considerations. Needed enabling legislation, ordinances, rules; statutory requirements and limitations, contractual considerations for intermunicipal cooperation; and public information and education.]

(4) Engineering Report or Facility Plan.

(A) General.

1. The engineering report or facility plan identifies and evaluates wastewater related problems; assembles basic information; presents criteria and assumptions; examines alternate projects, with preliminary layouts and cost estimates; describes financing methods, sets forth anticipated charges for users; reviews organizational and staffing requirements; offers a conclusion with a proposed project for client consideration; and outlines official actions and procedures to implement the project. The planning document must include sufficient detail to demonstrate that the proposed project meets applicable criteria.

2. The overall plan, including process description and sizing, factual data, and controlling assumptions and considerations for the functional planning of wastewater facilities are presented for each process unit and for the whole system. These data

form the continuing technical basis for the detailed design and preparation of construction plans and specifications.

3. Architectural, structural, mechanical, and electrical designs are usually excluded. Sketches may be desirable to aid in presentation of a project. Outline specifications of process units, special equipment, etc., are occasionally included.

4. Engineering reports must be completed for projects involving gravity sewers, pressure sewer systems, wastewater pumping stations and force mains. Facility plans must be completed for projects involving wastewater treatment facility projects and projects receiving funding through the grant and loan programs under 10 CSR 20-4.

A. Unless required by the Department, an engineering report will not have to be submitted for projects limited to only eight inch (8") (20 cm) gravity sewer extensions.

(B) Engineering Reports. Engineering reports shall contain the following information and other pertinent information as required by the Department:

1. Problem defined. Description of the existing system must include an evaluation of the conditions and problems needing correction.

2. Flow loads. The existing and design average and peak flows and waste load must be established. The basis of the projection of initial and future flows and waste load must be included and must reflect the existing, or initial service area, and the anticipated future service area. Flow loading information and data needed for new facilities are included in Paragraph (4)(C)4 of this rule.

3. Impact on existing wastewater facilities. The impact of the proposed project on all existing wastewater facilities, including gravity sewers, pump stations, and treatment facilities must be evaluated. Refer to 10 CSR 20-8.120 and 10 CSR 20-130.

4. Project description. A written description of the project is required.

5. Drawings. Drawings or sketches identifying the site of the project and anticipated location and alignment of proposed facilities are required.

6. Technical information and design criteria. All technical and design information used to design the collection system(s), pump station(s) and etc., must be provided either in the engineering report or in the summary of design and shall include, at a minimum, design tabulation flow, size and velocities; all pump station calculations including energy requirements; special appurtenances; stream crossings; and system map (report size). Outline unusual specifications, construction materials and construction methods; maps, photographs, diagrams; and other supporting data needed to describe the system. If an engineering report is not required, this information must be included in the summary of design. Refer to 10 CSR 20-8.110(5).

7. Site information. Project site information should include topography, soils, geologic conditions, depth to bedrock, groundwater level, floodway or floodplain considerations, distance to water supply structures, roads, residences, and other pertinent site information.

8. It is preferred that any request for a deviation from 10 CSR 20-8 be addressed along with the engineering justifications in the engineering report. Otherwise, all requests for deviations from 10 CSR 20-8.120 and 10 CSR 20-8.130 must accompany the plans and specifications.

(C) Facility Plans. Facility plans shall contain the following and other pertinent information as required by the Department:

1. Problem evaluation and existing facility review:

A. Descriptions of existing system including condition and evaluation of problems needing correction.

B. Summary of existing and previous local and regional wastewater facility and related planning documents, if applicable.

2. Planning and service area. Drawings identifying the planning area, the existing and potential future service area, the site of the project, and anticipated location and alignment of proposed facilities are required.

3. Population projection and planning period. Present and predicted population shall be based on a twenty (20)-year planning period. Phased construction of wastewater facilities shall be considered in rapid growth areas. Sewers and other facilities with a design life in excess of twenty (20) years shall be designed for the extended period.

4. Hydraulic capacity.

A. Flow definitions and identification. The following flows for the design year shall be identified and used as a basis for design for sewers, pump stations, wastewater treatment facilities, treatment units, and other wastewater handling facilities. Where any of the terms defined in this section are used in these design standards, the definition contained in this section applies.

(I) Design average flow – The design average flow is the average of the daily volumes to be received for a continuous twelve (12)-month period expressed as a volume per unit time. However, the design average flow for facilities having critical seasonal high hydraulic loading periods (e.g., recreational areas, campuses, and industrial facilities) shall be based on the daily average flow during the seasonal period.

(II) Design maximum day flow – The design maximum daily flow is the largest volume of flow to be received during a continuous twenty-four (24)-hour period expressed as a volume per unit time.

(III) Design peak hourly flow – The design peak hourly flow is the largest volume of flow to be received during a one (1)-hour period expressed as a volume per unit time.

(IV) Design peak instantaneous flow – The design peak instantaneous flow is the instantaneous maximum flow rate to be received.

B. Hydraulic capacity for existing collection and treatment systems.

(I) Projections shall be made from actual flow data, to the extent possible.

(II) The probable degree of accuracy of data and projections shall be evaluated. This reliability estimation shall include an evaluation of the accuracy of existing data, based on no less than one (1)-year of data, as well as an evaluation of the reliability of estimates of flow reduction anticipated due to infiltration/inflow (I/I) reduction or flow increases due to elimination of sewer overflows and backups.

(III) Critical data and methodology used shall be included. Graphical displays of critical peak wet weather flow data (refer to parts (4)(C)4.A.(II), (III), and (IV) of this rule) shall be included for a sustained wet weather flow period of significance to the project.

C. Hydraulic capacity for new collection and treatment systems.

(I) The sizing of wastewater facilities receiving flows from new wastewater collection systems shall be based on an average daily flow of one hundred (100) gallons (0.38 m^3) per capita per day plus wastewater flow from industrial

facilities and major institutional and commercial facilities unless water use data or other justification upon which to better estimate flow is provided.
(II) The one hundred (100) gallons (0.38 m^3) per capita per day figure shall be used which, in conjunction with a peaking factor from the following Figure 1, included herein, is intended to cover normal infiltration for systems built with modern construction techniques. Refer to 10 CSR 20-8.120.

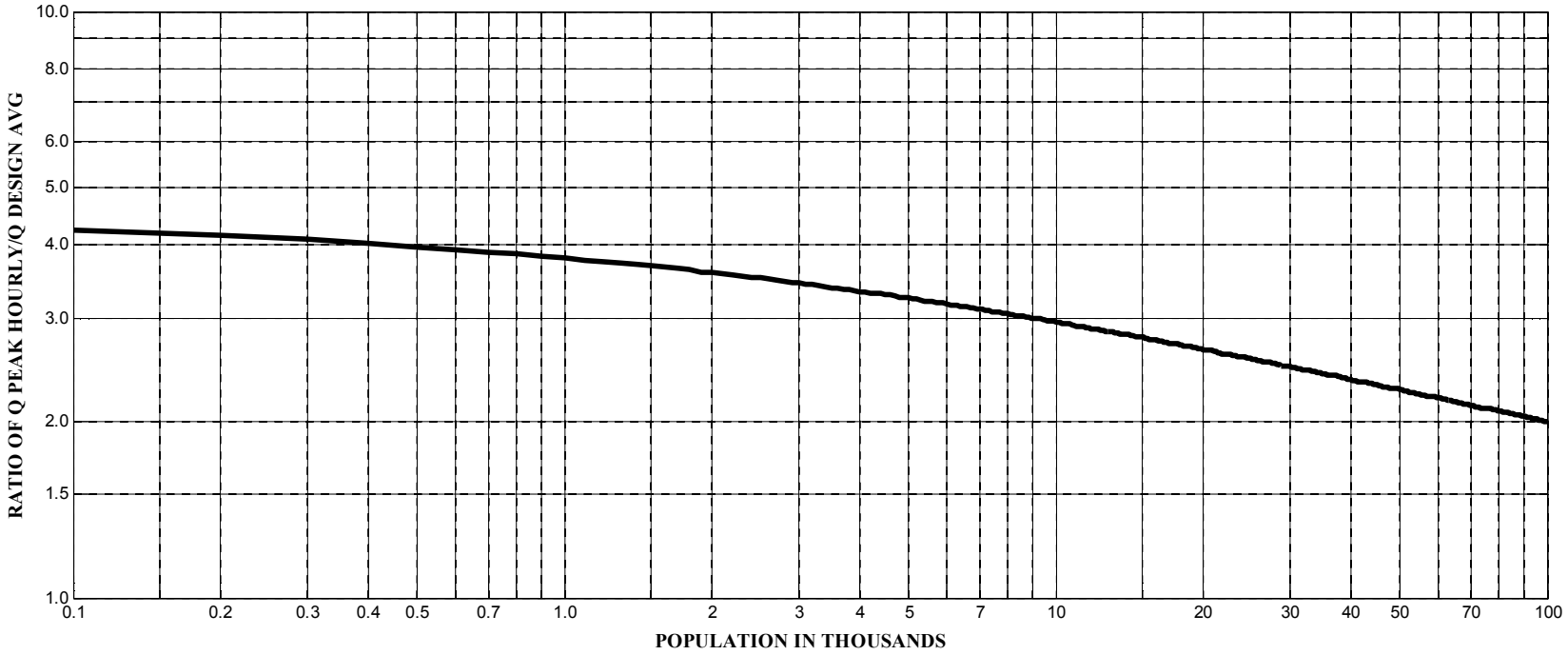

Figure 1. Ratio of peak hourly flow to design average flow.

where

Q peak hourly = Maximum Rate of Wastewater Flow (Peak Hourly Flow)
Q design avg = Design Average Daily Wastewater Flow

Equation: Q Peak Hourly/Q Design Avg $= \dfrac{18 + \sqrt{P}}{4 + \sqrt{P}}$

where

P = population in thousands

(III) If the new collection system is to serve existing development the likelihood of infiltration/inflow (I/I) contributions from existing service lines and non-wastewater connections to those services lines shall be evaluated and wastewater facilities designed accordingly.

D. Combined sewer interceptors. In addition to the above requirements, interceptors for combined sewers shall have capacity to receive sufficient quantity of combined wastewater for transport to treatment facilities to ensure attainment of the appropriate water quality standards.

5. Organic capacity.

A. Organic load definitions and identification. The following organic loads for the design year shall be identified and used as a basis for design of wastewater treatment facilities. Where any of the terms defined in this section are used in these design standards, the definition contained in this section applies.

(I) Biochemical oxygen demand – The five (5)-day Biochemical Oxygen Demand (BOD_5) is defined as the amount of oxygen required to stabilize biodegradable organic matter under aerobic conditions within a five (5)-day period.

(a) Total five (5)-day Biochemical Oxygen Demand ($TBOD_5$) is equivalent to BOD_5 and is sometimes used in order to differentiate carbonaceous plus nitrogenous oxygen demand from strictly carbonaceous oxygen demand.

(b) The carbonaceous five (5)-day Biochemical Oxygen Demand ($CBOD_5$) is defined as BOD_5 less the nitrogenous oxygen demand of the wastewater.

(II) Design average BOD_5 – The design average BOD_5 is generally the average of the organic load received for a continuous twelve (12)-month period for the design year expressed as weight per day. However, the design average BOD_5 for facilities having critical seasonal high loading periods (e.g., recreational areas, campuses, and industrial facilities) shall be based on the daily average BOD_5 during the seasonal period.

(III) Design maximum day BOD_5 – The design maximum day BOD_5 is the largest amount of organic load to be received during a continuous twenty-four (24)-hour period expressed as weight per day.

(IV) Design peak hourly BOD_5 – The design peak hourly BOD_5 is the largest amount of organic load to be received during a one (1)-hour period expressed as weight per day.

B. Design of organic capacity of wastewater treatment facilities to serve existing collection systems.

(I) Projections shall be made from actual wasteload data to the extent possible.

(II) Projections shall be compared to Subparagraph (4)(C)5.C of this rule and an accounting made for significant variations from those values.

(III) Impact of industrial sources shall be documented.

C. Organic capacity of wastewater treatment facilities to serve new collection systems.

(I) Domestic wastewater treatment design shall be on the basis of at least 0.17 pounds (0.08 kg) of BOD_5 per capita per day and 0.20 pounds (0.09 kg) of suspended solids per capita per day, unless information is submitted to justify alternate designs.

(II) Impact of industrial sources shall be documented.

(III) Data from similar municipalities may be utilized in the case of new systems. However, thorough investigation that is adequately documented shall be

provided to the Department to establish the reliability and applicability of such data.

6. Wastewater treatment facility design capacity. The wastewater treatment facility design capacity is the design average flow at the design average BOD_5. Refer to paragraphs (4)(C)4 and (4)(C)5 of this rule for peaking factors that will be required.

A. Engineering criteria. Engineering criteria and assumptions used in the design of the project shall be provided in the facility plan. Refer to subsection (4)(D) of this rule for additional information.

B. If the project includes the land application of wastewater, the requirements in 10 CSR 20-8.220 must be included with the facility plan.

7. Initial alternative development. For projects receiving funding through the grant and loan programs in 10 CSR 20-4, the process of selection of wastewater treatment and collection system alternatives for detailed evaluation shall be discussed. All wastewater management alternatives considered and the basis for the engineering judgment for selection of the alternatives chosen for detailed evaluation shall be included.

8. Detailed alternative evaluation. The following shall be included for the alternatives to be evaluated in detail.

A. Sewer system revisions. Proposed revisions to the existing sewer system including adequacy of portions not being changed by the project.

B. Wet weather flows. Facilities to transport and treat wet weather flows in a manner that complies with state and local regulations must be provided. The design of wastewater treatment facilities and sewers shall provide for transportation and treatment of all flows including wet weather flows unless the owner's National Pollutant Discharge Elimination System (NPDES) permit authorizes a bypass.

C. Site evaluation. When a site must be used which is critical with respect to these items, appropriate measures shall be taken to minimize adverse impacts.

(I) Compatibility of the treatment process with the present and planned future land use, including noise, potential odors, air quality, and anticipated sludge processing and disposal techniques, shall be considered. Non-aerated lagoons should not be used if excessive sulfate is present in the wastewater. Wastewater treatment facilities should be separate from habitation or any area likely to be built up within a reasonable future period and shall be separated in accordance with state and local requirements.

(II) Zoning and other land use restrictions shall be identified.

(III) An evaluation of the accessibility and topography of the site shall be submitted.

(IV) Area for future plant expansion shall be identified.

(V) Direction of prevailing wind shall be identified.

(VI) Flood considerations, including the twenty-five (25)-year and one hundred (100)-year flood levels, impact on floodplain and floodway, and compliance with applicable regulations in 10 CSR 20-8 regarding construction in flood-prone areas, shall be evaluated.

(VII) Geologic information, depth to bedrock, karst features, or other geologic considerations of significance to the project shall be included. A copy of a geological site evaluation from the Department's Division of Geology and Land Survey providing stream determinations (gaining or losing) must be included for

all new wastewater treatment facilities. A copy of a geological site evaluation providing site collapse and overall potentials from the Department's Division of Geology and Land Survey must be included for all earthen basin structures. Earthen basin structures shall not be located in areas receiving a severe overall geological collapse potential rating.

(VIII) Protection of groundwater including public and private wells is of utmost importance. Demonstration that protection will be provided must be included. If the proposed wastewater facilities will be near a water source or other water facility, as determined by the Department's Division of Geology and Land Survey or by the Department's Public Drinking Water Branch addressing the allowable distance between these wastewater facilities and the water source must be included with the facility plan. Refer to 10 CSR 20-8.130 and 10 CSR 20-8.140.

(IX) Soil type and suitability for construction and depth to normal and seasonal high groundwater shall be determined.

(X) The location, depth, and discharge point of any field tile in the immediate area of the proposed site shall be identified.

(XI) Present and known future effluent quality and monitoring requirements determined by the Department shall be included. Refer to subparagraph (4)(C) 8. N of this rule.

(XII) Access to receiving stream for the outfall line shall be discussed and displayed.

(XIII) A preliminary assessment of site availability shall be included.

D. Unit sizing. Unit operation and preliminary unit process sizing and basis shall be discussed.

E. Flow diagram. A preliminary flow diagram of treatment facilities including all recycle flows shall be provided.

F. Emergency operation. Emergency operation requirements as outlined in 10 CSR 20-8.130 and 10 CSR 20-8.140 shall be discussed and provided.

G. The no-discharge option must be examined and included as an alternative in the facility plan.

H. Technology not included in these standards. 10 CSR 20-8.140 outlines procedures for introducing and obtaining approval to use technology not included in these standards. Proposals to use technology not included in these standards must address the requirements of 10 CSR 20-8.140.

I. Biosolids. The solids disposal options considered and method selected must be included. This is critical to completion of a successful project. Compliance with requirements of 10 CSR 20-8.170 and any conditions in the owner's National Pollutant Discharge Elimination System (NPDES) permit must be assured.

J. Treatment during construction. A plan for the method and level of treatment to be achieved during construction shall be developed and included in the facility plan that must be submitted to the Department for review and approval. This approved treatment plan must be implemented by inclusion in the plans and specifications to be bid for the project. Refer to paragraph (5)(A)5 and subsection (7)(D) of this rule.

K. Operation and maintenance. Portions of the project which involve complex operation or maintenance requirements shall be identified including laboratory requirements for operation, industrial sampling, and self monitoring.

L. Cost estimates. Cost estimates for capital and operation and maintenance (including basis) must be included for projects receiving funding through the grant and loan programs in 10 CSR 20-4.

M. Environmental review.

(I) Compliance with planning requirements of local government agencies must be documented.

(II) Any additional environmental information meeting the criteria in 10 CSR 20-4.050, for projects receiving funding through the state grant and loan programs.

N. Water quality reports. Include all reviews, studies or reports required by 10 CSR 20-7, Water Quality, and approved by the Department. Any information or sections in an approved study or report required by 10 CSR 20-7 that addresses the requirements in Subsection (4)(C) of this rule can be incorporated into the facility plan in place of these sections.

9. Final project selection. The project selected from the alternatives considered under Paragraph (4)(C)10 of this rule shall be set forth in the final facility plan document to be forwarded to the Department for review and approval, including the financing considerations and recommendations for implementation of the plan.

10. It is preferred that any request for a deviation from 10 CSR 20-8 be addressed along with the engineering justifications in the facility plan. Otherwise, all requests for deviations along with the engineering justification from 10 CSR 20-8.120 through 10 CSR 20-8.220 must accompany the plans and specifications.

[(*B)*] **(D)** Appendices. Technical Information and Design Criteria. **Due to the complexity of wastewater facilities or funding issues, the following information shall be included upon the request of the Department. All system design information can be submitted as, and for all review purposes, will be considered preliminary design data.**

[*1. Collection system. Design tabulation- flow, size, velocities, etc.; regulator or overflow design; pump station calculations including energy requirements; special appurtenances; stream crossings; and system map (report size).]*

[*2.*] **1.** Process facilities. Criteria selection and basis; hydraulic and organic loadings-minimum, average, maximum and effect (wastewater and sludge processes); unit dimensions; rates and velocities; detentions concentrations; recycle; chemical additive control; physical control and flow metering; removals; effluent concentrations, etc. (include a separate tabulation for each unit to handle solid and liquid fractions); energy requirement; and flexibility.

[*3.*] **2.** Process diagrams. Process configuration, interconnecting piping, processing, flexibility[*, etc.*]; hydraulic profile; organic loading profile; solids profile; solids control system; and flow diagram with capacities, etc.

[*4.*] **3.** Laboratory. Physical and chemical tests and frequency to control process; time for testing; space and equipment requirements; and personnel requirements—number, type, qualifications, salaries, benefits (tabulate) **and a brief description of the laboratory facility. See 10 CSR-20.140.**

[*5.*] **4.** Operation and maintenance. Routine special maintenance duties; time requirements; tools, spare parts, equipment, vehicles, safety[*, etc.*]; maintenance workspace and storage; and personnel requirements—number, type, qualifications, training, salaries, benefits (tabulate).

[*6. Office space for administrative personnel and records.*]

[*7. Personnel services. Locker rooms and lunch rooms.*]

[*8.*] **5.** Chemical control. Processes needing chemical addition; chemicals and feed equipment; tabulation of amounts and unit and total costs.
[*9.*] **6**. Collection systems control. Cleaning and maintenance; regulator and overflow inspection and repair; flow gauging; industrial sampling and surveillance; ordinance enforcement; equipment requirements; trouble-call investigation; and personnel requirements—number, type, qualifications, salaries, benefits, training (tabulate).
[10.] **7**. Control summary. Personnel; equipment; chemicals, utilities, list power requirements of major units; and summation.
[*11. Support data. Outline unusual specifications, construction materials and construction methods; maps, photographs, diagrams; and other.*]

[(5) Preliminary Design Review. On all grant projects the consulting engineer shall submit the project for review at approximately a twenty percent (20%) design stage. The design information to be submitted shall include a layout of the study area delineating all proposed improvements, including subareas, with contributing flows and design populations. All calculations regarding sizing of lift stations and treatment plan units shall also be included. A conference between the consultant and the review engineer may be arranged to discuss the project.]

(5) Summary of Design. A summary of design shall accompany the plans and specifications and shall include the following:

(A) Flow and waste projections including design and peak hydraulic and organic loadings shall be provided for sewers, pump stations, and wastewater treatment facilities. Information shall be submitted to verify adequate downstream capacity of sewers, pump stations, and wastewater treatment and sludge handling unit(s);

(B) Type and size of individual process units including unit dimensions; rates and velocities; detention times; concentrations; recycle; chemical additive control; physical control, flexibility and flow metering;

(C) Show process diagrams, including flow diagrams with capacities;

(D) Expected removal rates and concentrations of permitted effluent parameters in the discharge from the wastewater treatment facility, including a separate tabulation for each unit to handle solid and liquid fractions;

(E) Design calculations, tabulations, assumptions and deviations from 10 CSR 20-8.120 through 10 CSR 20-8.220 used in the design of the system(s);

(F) Include unusual specifications, construction materials and construction methods; maps, photographs, diagrams; and other support data needed to describe the system;

(G) Unless required in 10 CSR 20-8.120 through 10 CSR 20-8.220, specific design calculations for the architectural, structural, and mechanical components of a system do not have to be included with the design criteria.

(6) Plans.

(A) General.

1. One (1) set of drawings shall be submitted to the Department for review. In addition to the set of drawings, an electronic version of the plans can be submitted to assist in the review. Additional sets of drawings may be required by the Department for final approval.

2. Plan title. All plans for [*sewage works*] **wastewater facilities** shall bear a suitable title showing the name of the municipality, sewer district or institution; and shall show the scale

in feet, a graphical scale, the north point, [*data*] **date** and the name of the engineer, certificate number and imprint of his/her registration seal **with the engineer's signature**. [*A space should be provided for signature and/or approval stamp of the appropriate reviewing and approving officials and/or agencies.*]

3. Plan format. The plans shall be clear and legible (suitable for microfilming **or scanning**). They shall be drawn to [*a*] scale**,** which will permit all necessary information to **be** plainly shown **for review and suitable for the contracting and construction of the facilities.**

A. [*The size of the plans generally should not be larger than thirty by forty-two inches (30" x 42") (76 cm x 107 cm).*] **To allow for microfilming or scanning, plans must not be smaller than twenty-four inches by thirty-six inches (24" x 36") (61 cm x 91 cm) or larger than thirty-six by forty-eight inches (36" x 48") (91.4 cm x 122 cm).** Datum used [*should*] **shall** be indicated. Locations and logs of test borings, when [*made*] **required**, shall be shown on the plans. **Test boring logs must be included on the plans or in the specifications as an appendix.** Blueprints shall not be submitted.

4. Plan contents. Detail plans shall consist of**:** plan views, elevations, sections and supplementary views which, together with the specifications and general layouts, provide the working information for the contract and construction of the [*works*] **facilities**. **They shall also** include dimensions and relative elevations of structures, the location and outline form of equipment, location and size of piping, water levels, and ground elevations.

5. Operation during construction. Project construction documents shall specify the procedure for operation during construction that complies with the plan required by Part (4)(C)8.J and Subsection (7)(D) of this rule.

(B) Plans of Sewers.

1. General plan. A [*comprehensive*] plan of [*the*] existing and proposed sewers shall be submitted for projects involving new sewer systems and substantial additions to existing systems. This plan shall show the following:

A. Geographical features.

(I) Topography and elevations. Existing or proposed streets and all streams or water surfaces shall be clearly shown. Contour lines at suitable intervals should be included.

(II) Streams. The direction of flow in all streams and high and low water elevations of all water surfaces [*at sewer outlets*] and overflows shall be shown.

(III) Boundaries. The boundary lines of the municipality [*and*] **or** the sewer district**,** [*or*] **and the** area to be sewered shall be shown.

B. Sewers. The plan shall show the location, size and direction of flow of all existing and proposed sanitary and combined sewers draining to the treatment [*works*] **facility** concerned.

2. Detail plans. Detail plans shall be submitted. Profiles [*should*] **shall** have a horizontal scale of not more than one hundred feet (100') to the inch (12 m to the cm) and a vertical scale of not more than ten feet (10') to the inch ([*12 dm*] **1.2 m** to the cm). Plan view**s** should be drawn to a corresponding horizontal scale **and must be shown on the same sheet**. Plans and profiles shall show[**—**]**:**

A. Location of streets and sewers;

B. Line of ground surface, pipe size, length between manholes, invert and surface elevation at each manhole, grade of sewer between each two (2) adjacent manholes**,** [*and*] pipe material and type**, and** where special construction features are required. All manholes shall be numbered on the plan and correspondingly numbered on the profile.

C. Where there is any question of the sewer being sufficiently deep to serve any residence, the elevation and location of the basement floor shall be plotted on the profile of the sewer which is to serve the house in question. The engineer shall state that all sewers are sufficiently deep to serve adjacent basements except where otherwise noted on the plans;

[*C.*] **D.** Locations of all special features such as inverted siphons, concrete encasements, elevated sewers, etc.;

[*D.*] **E.** All known existing structures and utilities both above and below ground**,** which might interfere with the proposed construction[*,*] **or require isolation setback,** particularly water mains[*,*] **and water supply structures (i.e., wells, clear wells, basins, etc.),** gas mains[*and*]**,** storm drains[*;*]**, telephone, cable and power conduits**; and

[*E.*] **F.** Special detail drawings, made to a scale to clearly show the nature of the design**,** [*and*] **shall be furnished to show** the following particulars:

(I) All stream crossings [*and sewer outlets,*] with elevations of the stream bed and [*of normal and extreme*] high**, normal,** and low water levels;

(II) Details of all special sewer joints and cross-sections; details of all sewer appurtenances such as manholes, lampholes, inspection chambers, inverted siphons, regulators, tide gates and elevated sewers.

(C) Plans of [*Sewage*] **Wastewater** Pumping Stations.

1. Location plan. A plan shall be submitted for projects involving construction or revision of pumping stations. This plan shall show the following: the location and extent of the tributary area; any municipal boundaries with the tributary area; the location of the pumping station and force main; and pertinent elevations.

2. Detail plans. Detail plans shall be submitted showing the following, where applicable:

A. Topography of the site;

B. Existing pumping station;

C. Proposed pumping station, including provisions for installation of future pumps[*or ejectors*];

D. Elevation of high water at the site and maximum elevation of [*sewage*] **wastewater** in the collection system upon occasion of power failure;

E. Maximum hydraulic gradient in downstream gravity sewers when all installed pumps are in operation; and

F. Test boring and groundwater elevations.

(D) Plans of [*Sewage*] **Wastewater** Treatment Plants.

1. Location plan.

A. A plan shall be submitted showing the [*sewage*] **wastewater** treatment plant in relation to the remainder of the system.

B. Sufficient topographic features shall be included to indicate its location with relation to streams and the point of discharge of treated effluent.

2. General layout. Layouts of the proposed [*sewage*] **wastewater** treatment plant shall be submitted showing:

A. Topography of the site;

B. Size and location of plant structures;

C. Schematic flow diagram**(s)** showing the flow through various plant units and [*for the various*] **showing** utility systems serving the plant processes;

D. Piping, including any arrangement for bypassing individual units; materials handled and direction of flow through pipes **shall be shown**;

E. Hydraulic profiles showing the flow of [*sewage*] **wastewater**, supernatant [*liquid*] **liquor** and sludge; **and**

F. Test borings[*;]* and groundwater elevations shall be provided.

3. Detail plans. Detail plans shall show the following, unless otherwise covered by the specifications or [*engineer's reports*—] **facility plan**:

A. Location, dimensions and elevations of all existing and proposed plant facilities;

B. Elevation**s** of high and low water level of the body of water to which the plant effluent is to be discharged;

C. Type, size, pertinent features and operating capacity of all pumps, blowers, motors and other mechanical devices;

D. Minimum, **design** average, and [*maximum*] **peak hourly** hydraulic flow in profile; and

E. Adequate description of any other features pertinent to the design.

(7) Specifications.

(A) Complete technical specifications **shall be submitted** for the construction of sewers, [*sewage*] **wastewater** pumping stations, [*sewage*] **wastewater** treatment plants and all appurtenances **and** shall accompany the plans.

(B) The specifications accompanying construction drawings shall include, but not be limited to, all construction information not shown on the drawings which is necessary to inform the builder**,** in detail**,** of the design requirements [*as to*] **for** the quality of materials**,** [*and*] workmanship and fabrication of the project[*and*]**.**

(C) The specifications shall also include: the type, size, strength, operating characteristics and rating of equipment; allowable infiltration; the complete requirements for all mechanical and electrical equipment, including machinery, valves, piping and jointing of pipe; electrical apparatus, wiring, instrumentation and meters; laboratory fixtures and equipment; operating tools; construction materials; special filter materials such as stone, sand, gravel or slag; miscellaneous appurtenances; chemicals when used; instructions for testing materials and equipment as necessary to meet design standards; and performance tests for the completed [*works*] **facilities** and component units. It is suggested that these performance tests be conducted at design load conditions wherever practical.

(D) Operation during construction. Specifications shall contain a program for keeping existing wastewater treatment plant units in operation during construction of plant additions. Should it be necessary to take plant units out of operation, specifications shall include detailed construction requirements and schedules to avoid unacceptable temporary water quality degradation in accordance with Subparagraph (4)(C)8.J and Paragraph (5)(A)5 of this rule.

(8) Revisions to Approved Plans. Any deviations from approved plans or specifications affecting capacity, flow, **system layout,** operation of units or point of discharge shall be approved **by the Department** in writing before such changes are made. Plans or specifications so revised should**, therefore,** be submitted [*therefore,*] well in advance of any construction work which will be affected by [*the*] **such** changes, to permit sufficient time for review and approval. Structural revisions or other minor changes not affecting capacities, flows or operation will be permitted during construction without approval. As[-] built plans clearly showing the alterations shall be submitted to the [*agency*] **Department** at the completion of the work.

[*(9) Operation During Construction. Specifications shall contain a program for keeping existing treatment plant units in operation during construction of plant additions. Should it be necessary to take plant units out of operation, a shutdown schedule which will minimize pollutional effects on the receiving stream shall be reviewed and approved in advance by the agency and shall be adhered to.*]

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**Original authority 1972, amended 1973, 1987, 1993.*